



**Service Instructions
for
Table Top Refrigerated Centrifuge
Z 400 K**

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6 TECHNICAL DATA

6.1 Acceleration times Z 400 and Z 400 K (120 V / 230 V) in seconds

Rotor-number	fast	slow
220.27 V02	45	120
220.86 V01	45	103
220.50 V06	30	60
220.81 V06	25	37
220.96 V02	27	63
220.97 V02	23	49
220.87 V03/V04	34	42
220.88 V01	28	37
220.92 V01	25	37
221.02 V01	30	60
221.03 V01	30	65
220.93 V01	45	105
221.08 V01	67	120
221.16 V01	40	55

6.2 Deceleration times Z 400 and Z 400 K (120 V / 230 V) in seconds

Rotor-number	fast	Slow
220.27 V02	52	100
220.86 V01	51	97
220.50 V06	30	77
220.81 V06	30	57
220.96 V02	26	60
220.97 V02	40	115
220.87 V03/V04	55	62
220.88 V01	33	57
220.92 V01	30	57
221.02 V01	40	60
221.03 V01	30	60
220.93 V01	50	100
221.08 V01	58	110
221.16 V01		

6.3 Imbalance shut off data Z 400 K (120 V / 230 V)

Rotor-number	Shut off speed in rpm	Admissible imbalance in gram	Shut off imbalance in gram
220.27 V02	900 - 1000	12	14
220.86 V01	900 - 1000	12	14
220.50 V06	900 - 1000	24	26
220.81 V06	1100 - 1200	30	32
220.96 V02	900 - 1000	30	32
220.97 V02	900 - 1000	28	30
220.87 V03/V04	1100 - 1200	15	17
220.88 V01	6000 - 6500	10	12
220.92 V01	6000 - 6500	12	14
221.02 V01	800 - 900	14	16
221.03 V01	900 - 1000	12	14
220.93 V01	800 - 900	18	24
221.08 V01	900 - 1000	8	10
221.16 V01	900 - 1100	18	22

6 TECHNICAL DATA

6.4 Lowest temperatures Z 400 K (120 V / 230 V)

Rotor-number	max.-rpm
220.27 V02	- 8°C
220.86 V01	- 8°C
220.50 V06	- 10°C
220.81 V06	- 10°C
220.96 V02	- 10°C
220.97 V02	- 10°C
220.87 V03/V04	-2°C
220.88 V01	- 4°C
220.92 V01	- 4°C
221.02 V01	- 4°C
221.03 V01	- 4°C
220.93 V01	- 8°C
221.08 V01	+ 2°C
221.16 V01	-8°C

Ambient temperature: 23°C

The absolute end temperatures can be subject to fluctuations of $\pm 2^{\circ}\text{C}$ due to power tolerances of the refrigeration unit.

The lowest sample temperatures are depending on the ambient temperature. If the ambient temperature is increasing, the lowest sample temperature to be reached is increasing as well.

7 SERVICE INSTRUCTIONS

7.1 General technical description

Model **Z 400 K** is a micro processor controlled refrigerated centrifuge.
The actuation is a three phase asynchronous motor which is controlled by a frequency converter.
Model **Z 400 K** has an independent error detection program, displaying possible errors and therefore supporting the trouble shooting process.

This unit is equipped with several safety features:

- Imbalance detection
- Motor over temperature protection

Please follow below mentioned safety instructions for any kind of service actions:

- The capacitor of the frequency converter can be under voltage even when the unit is switched off.
- Do not leave units unsupervised, when parts of the housing have been removed and the unit is still connected to the main power supply.
- Do not bypass the lid's safety contacts and never work with the unit's lid open.
- The VDE regulations are valid for all electrical work that has to be done.

7.2 Electrical and electronically components

7.2.1 Power board

The power board is serving the low voltage supply of the centrifuge control system.
All fine wire fuses for the different distribution voltages are placed on the power board.
The power board is electrically isolated and has an electric strength of 4 KV. It is also the central switching point for all inputs and outputs.
The signal line to the micro processor control is consisting of a flat belt cable.
All plug connections are placed in such a way, that they cannot be accidentally misconnected.

7.2.2 Operation / Control panel

The control panel controls the entire centrifuge.
If there is a defect you have to exchange the complete panel, not only the printed circuit board.
The signal line leads to the control panel.
The safety features are additionally protected by a hardware circuit on the power board.
In case an error occurs, the error no. is being indicated on the speed display.

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7.2.3 Frequency converter

The frequency converter generates the drive signals for the asynchronous motor.

The converter leads the current generated by the motor during deceleration to a heating resistor to reduce the current.

The frequency converter is connected with the power board by a serial interface.

There is a green LED on the converter which flashes when the frequency converter is working correctly. A defect of the converter will be indicated in the speed display as an error no. (see chapter 5).

7.2.4 Rotor recognition and over speed protection

The centrifuge will recognize the inputted rotor through the rotor identification sensor automatically.

If the pre selected rpm are higher as the permitted rpm of the rotor, the rpm pre selection indication will flash at approx. 250 rpm.

But the regulation will accelerate the rotor only to its permitted rpm of the rotor. Simultaneous the rpm of the rotor will still supervised by a regulation of the hardware which is integrated to the power board.

7.2.5 Speed signal

The actual speed is extracted by a hall-effect-sensor placed on the lower side of the motor.

The actual signal is transmitted by the power board to the control board and the converter.

7.2.6 Lid contact

The micro switch in the mechanism of the lid lock controls correct closing of the centrifuge lid.

The switch may never be bypassed.

The lid lock is unlatched by an electro magnet, receiving its signal from the power board.

7.2.7 Imbalance detection

The imbalance detection is effected by a vibration switch, which is controlling the oscillating motion of the motor. The unit stops when the oscillating motions are too strong.

Therefore you have to follow the adjustment instructions stated by the manufacturer.



7 SERVICE INSTRUCTIONS

7.3 Self test program

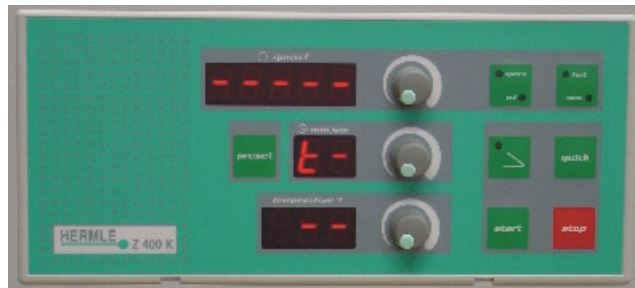
7.3.1 Activating the self test program

The self test program helps the service personnel to locate defects. It is graded in seven test areas from chapter 7.3.2 to 7.3.8.

The program can be started as follows:

- Open lid of the centrifuge and switch off main switch
- Turn "TIMER" potentiometer to the left limit stop (counter-clockwise)
- Press the keys "PRESET" and  hold them and at the same time switch on the unit.
- After the indication displays flash on, let go of the keys "PRESET" and 

Each digit must now show a minus (-) symbol, except the "MIN/SEC" display. It will display special digits each of them standing for a specific test area. The test area can be selected by turning the time pre-set potentiometer.




7.3.2 Keyboard test

The keyboard test is used for checking the correct function of the foil keyboard.

Activate the self test program as described in chapter 7.3.1.

Turn the time pre-set potentiometer until the special digit "t" appears in the left window of the "MIN/SEC" display.

Each digit refers to a key. The digit will appear in the right window of the "MIN/SEC" display after pressing the according key. See digit reference list below for details. By pressing key "START" this part of the program will be activated.

KEY	DIGIT
PRESET	1
 = LID	2
QUICK	3
START	4
SPEED / RCF	5
FAST / SLOW	6
STOP	Exit keyboard test



In case one of these digits does not appear or the keyboard test can not be started or exited, you will have to replace the entire control panel.

7 SERVICE INSTRUCTIONS

7.3.3 Indication test

Activate the self test program as described in chapter 7.3.1.

Turn the time pre-set potentiometer until the special digit "d" appears.

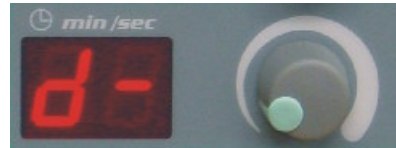
Press key "START" to activate the indication test.

Digits from 0 to 9 appear in all displays in 1 sec. intervals.

The LED's on the keys, the minus symbol (-) in the temperature display and the comma symbol (,) also flash in ½ sec. intervals.

With this test you can check, whether the displays are working properly. Please watch carefully, whether all seven segments of each digital display are working correctly.

Exit the indication test by pressing key "STOP".



7.3.4 Input signal test

ATTENTION:

During this self test it is possible that the motor is triggered uncontrolled by the converter.

That means, the motor could start turning without pressing the "START" key.

Please make sure there is nothing inside the rotor chamber except the tightened rotor during the self test.

TAKE CARE OF YOUR FINGERS!

The input signal test is used for checking the input signals

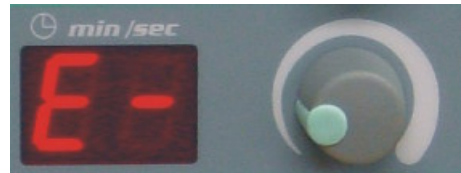
- LID LOCK
- SPEED SENSOR
- ROTOR SENSOR
 - SLOW TRACK
 - FAST TRACK
- IMBALANCE SENSOR
- SERIAL INTERFACE
- CONVERTER

7 SERVICE INSTRUCTIONS

Activate the self test program as described in chapter 7.3.1.

Turn the time pre-set potentiometer until the special digit "E" appears.

Press key "START" to activate the input signal test.



Each special digit refers to an input signal. The digit will appear in the left window of the "MIN/SEC" display. The according input signal can be selected by turning the time pre-set potentiometer.

The state of the input signal will be indicated in the right window of the "MIN/SEC" display.

"1" means signal is existent, responsible a contact is made.

"0" means signal is non-existent.

Description of special digits:

Lid lock:

Turn the time pre-set potentiometer to position "L".

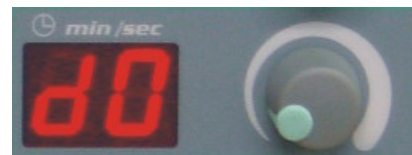
The right window of the "MIN/SEC" display must indicate "0". When closing the lid, the display will indicate "1".



Speed sensor:

Turn the time pre-set potentiometer to position "d".

When turning the motor by hand, the right window of the "MIN/SEC" display must switch from "0" to "1".



Rotor sensor:

The rotor sensor exists out of two hall effect sensors. This will recognise a slow and a fast track of the rotor identification ring.

If you do not have a rotor with the described identification ring, you can also use a permanent magnet. Strike to the sensor to get the signal.

Turn the time pre-set potentiometer to position "S" (slow track).

Put a rotor with a slow track identification into the unit and tighten it (rotor has to reach not more than 6000 rpm).

When turning the rotor by hand, the right window of the "MIN/SEC" display must switch from "0" to "1".



7 SERVICE INSTRUCTIONS

Turn the time pre-set potentiometer to position "H" (fast track).
Put a rotor with a fast track identification into the unit and tighten it (rotor has to reach more than 6000 rpm).
When turning the rotor by hand, the right window of the "MIN/SEC" display must switch from "0" to "1".



Imbalance sensor:

Turn the time pre-set potentiometer to position "I".
When the unit is being shocked, the right window of the "MIN/SEC" display will indicate "1".



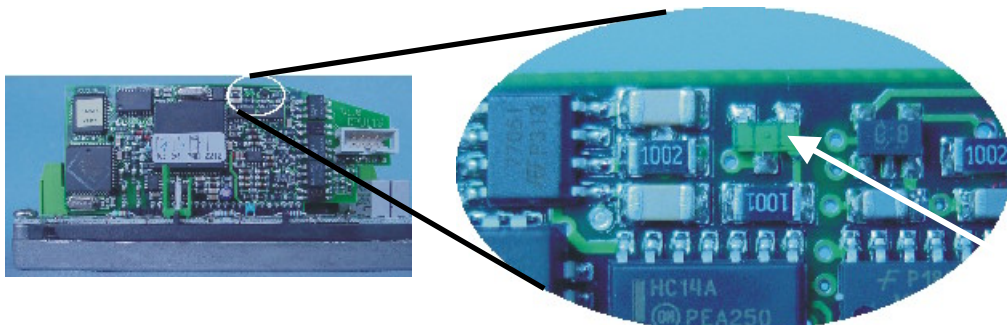
Serial interface:

Turn the time pre-set potentiometer to position "C".
When the lid is closed, the right window of the "MIN/SEC" display must switch to "1" and the green LED at the converter has to flash.



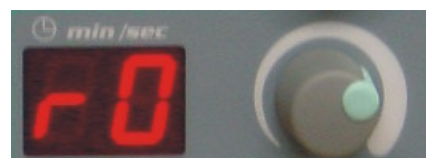
Overview

Detail



Converter (readiness for service):

Turn the time pre-set potentiometer to position "r".
When the lid is closed, the right window of the "MIN/SEC" display must switch to "1". At the same time the green LED will flash at the frequency converter (see above).



The input signal test can be exited by pressing the "STOP" key and returned to the main menu.

7 SERVICE INSTRUCTIONS

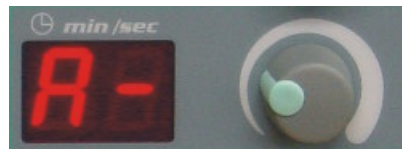
7.3.5 Output signal test

The output signal test is used for checking the output signals

- BRAKE / FAN RELAY
- REFRIGERATION
- CONVERTER RELAY
- LID LOCK
- AC (out of order)

Activate the self test program as described in chapter 7.3.1.

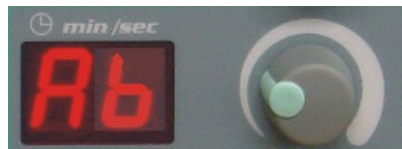
Turn the time pre-set potentiometer until the special digit "A" appears.



- Each special digit refers to an output signal. The digit will appear in the right window of the "MIN/SEC" display. For these tests the lid of the centrifuge has to be closed.

Break or Fan relay:

Press key "START". The special digit "b" must appear. The airing starts as long as you keep this key pressed.



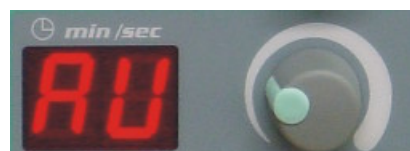
Refrigeration:

Press key "QUICK". The special digit "F" must appear and the compressor must turn on. Refrigeration is on as long as you keep this key pressed.




Converter relay:

Press key "PRESET". The special digit "U" must appear, the converter relay must turn on as well as the green LED on the converter. (look at the picture inside the input signal test „CO“)



Lid lock:

Press key . The special digit "L" must appear and at the same time the lid has to open with chatter.



7 SERVICE INSTRUCTIONS

AC: without function



The output signal test can be exited by pressing the "STOP" key.

7.3.6 Indication of software version

Activate the self test program as described in chapter 7.3.1.

Turn the time pre-set potentiometer until the special digit "S" appears.



Press key "START" and the software version will be indicated in the "MIN/SEC" display.
"17" e.g. means version 1.7



The software version should always be indicated at questions!

7.3.7 Extracting frequency converter data

Activate the self test program as described in chapter 7.3.1.

Turn the time pre-set potentiometer until the special digit "FC" appears.



Close the lid and press key "START", to extract converter data.

Each special digit refers to a signal. The digit will appear in the left window of the "RPM" display.

The according functions can be selected by turning the speed pre-set potentiometer.



Converter voltage coding:

Turn the speed pre-set potentiometer to position "J".

In the right window of the "RPM" display the coded voltage is indicated, e.g. "230" for 230 V units, "115" for 115 V units.



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Link voltage:

Turn the speed pre-set potentiometer to position "U".

In the right window of the "RPM" display the link voltage is indicated. This is the internally rectified line voltage rectified by the converter.

230 V units: approx. 325

120 V units: approx. 195



Converter software version:

These are purely informative data, which should be referred to when contacting our service department.

Turn the speed pre-set potentiometer to position "So".

In the right window of the "RPM" display the software version is indicated.



7.3.8 Motor run-in

Is there a new motor to be used in this unit, you have to use this function for the initial operation.

Activate the self test program as described in chapter 7.3.1.

Turn the time pre-set potentiometer until the special digit "m" appears.



Insert the rotor available with highest speed and tighten it.
Close the lid and press the key "START".

The unit starts now the 10 min. run-in phase. Speed is accelerated in 10 increments of 1 min. each until reaching the max. speed of the rotor.



The run-in phase can be ended at any time by pressing the "STOP" key.

Exit this function after running-in of the motor by pressing key "STOP".

Exit the self test program by switching the centrifuge off.

7.3.9 Operation menu

By using the operation menu different data of this unit can be extracted:

- Operation hours indication
- Operation minutes indication
- Start counter

7.3.9.1 Starting the operation menu

The operation menu is started as follows:

- Open the lid of the centrifuge.
- Turn the time pre-set potentiometer to its left limit stop.
- Press key "PRESET" and hold it while switching the unit on again.
- Let go of the key "PRESET", after all displays flashed on.

You have now entered the operation menu.

By turning the time pre-set potentiometer you can choose any function of the operation menu. The functions are indicated by special digits in the "MIN/SEC" display. The selected information is indicated in the "RPM" display.

7.3.9.2 Operation hours indication

Turn the time pre-set potentiometer to position "h".

The operation hours of the unit will be indicated in the "RPM" display.

The range is from 0 to 99.999 hours.

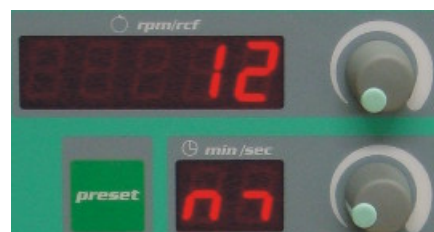


7.3.9.3 Operation minutes indication

Turn the time pre-set potentiometer to position "m".

The operation minutes of the unit will be indicated in the "RPM" display.

The range is from 0 to 59 minutes.



7 SERVICE INSTRUCTIONS

7.3.9.4 Start counter

Turn the time pre-set potentiometer to position "t".

The number of unit starts will be indicated in the "RPM" display.

The range is from 0 to 99.999 starts.



DExit the operation menu by switching the centrifuge off.

7.4 Mounting support

After performing any kind of assembling work, please make sure all the grounded contacts are connected correctly!

7.4.1 Replacing the control panel

- Unlatch the frame of the control panel with a small screw driver (see figure 19).
- Pull the lower edge of the control panel out of the front housing as indicated in figure 20.
- Pull the control panel out of the upper guide (see figure 21).
- Remove all electric connections.
- Place the new control panel into the front housing in reverse order.

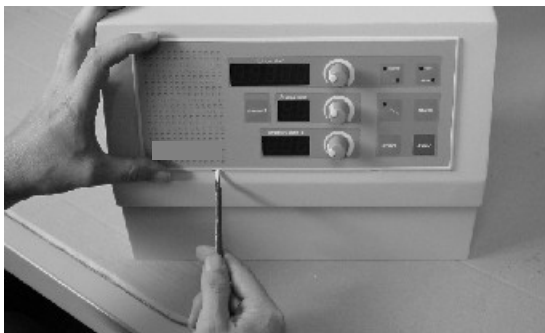


figure 19

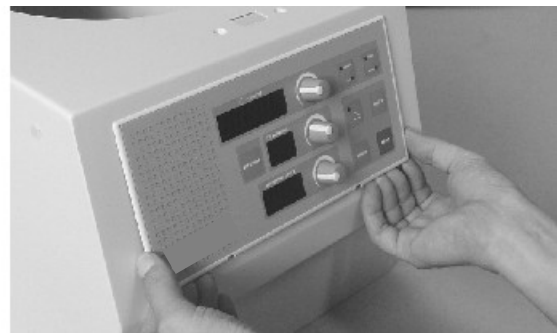


figure 20



figure 21

7 SERVICE INSTRUCTIONS

7.4.2 Replacing the lid lock

- Remove the control panel as described in chapter 7.4.1
- Remove the lid lock with the 2 visible screws (to be seen from above) as well as the emergency lid release cord at the left side of the housing.
- Remove all electric connections.



Switch

Coil

7.4.3 Removing the housing

- Remove the control panel as described in chapter 7.4.1.
- Remove the lid lock as described in chapter 7.4.2.
- Remove screws 1 to 6 at the housing (figure 22)

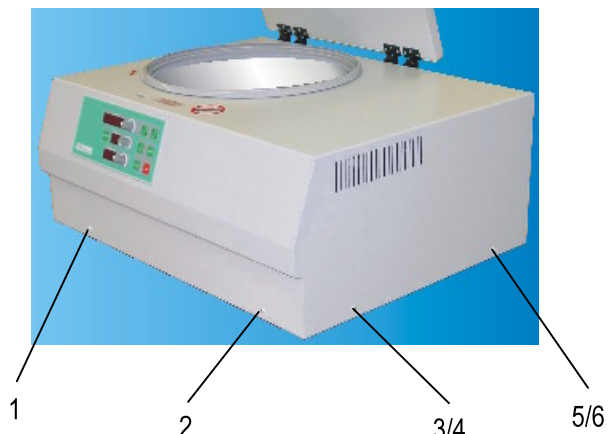


figure 22

- Remove the ground wire from the housing.
- Remove the housing upwards.
- Re-assemble the unit in reverse order.

7 SERVICE INSTRUCTIONS

- Make sure the lid sealing, which is also the rotor chamber sealing, is placed correctly. You can use a small allen key. Push it between sealing and rotor chamber. Pull the sealing in a circular movement towards the chamber's centre (figure 23)



figure 23

7.4.4 Removing the lid

- Remove the control panel and housing as described in chapter 7.4.1 and 7.4.3.
- Open the lid as wide as possible.
- Hold the lid with one hand and remove the fixing screws of the hinges (see figure 24) Take care of the lid holder sheet metal.
- The lid can now be removed completely.

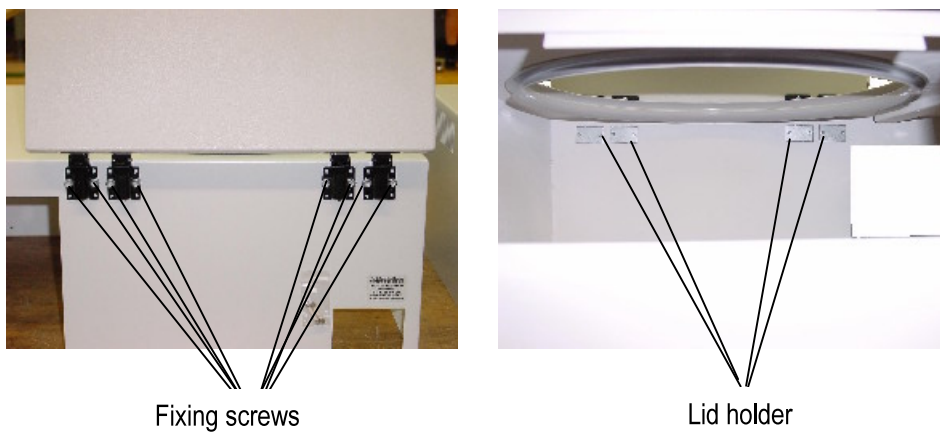


figure 24

7 SERVICE INSTRUCTIONS

7.4.5 Replacing the motor

- Remove the control panel and housing as described in chapter 7.4.1 and 7.4.3.
- Remove the connections from the power board and the frequency converter leading to the motor.
- Remove the screws from the rotor fixing brackets (figure 25).
- Remove motor fixing screws 1-3 (figure 26).
- Lift the motor out of the unit.
- When re-assembling the spare motor, take care of the wirings, as they must not be jammed.
- When tightening the motor mount screws, please pay attention the motor rubber mounts are not being twisted.
- Re-assemble the unit in reverse order.

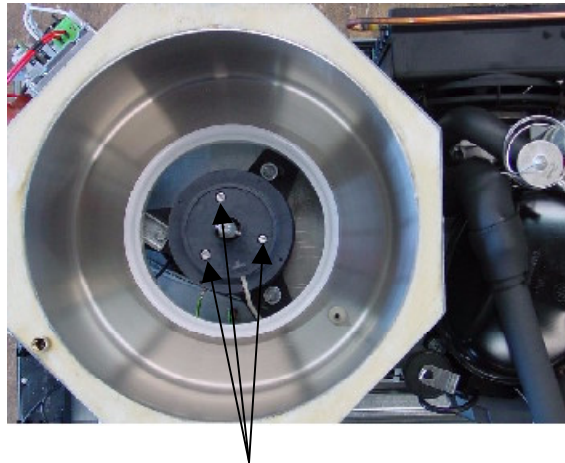


figure 25

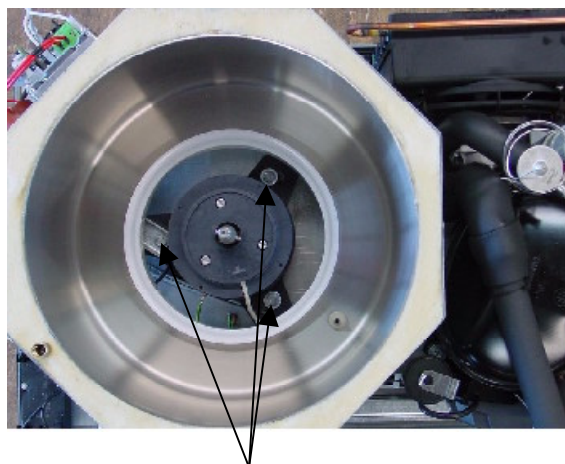


figure 26

7 SERVICE INSTRUCTIONS

7.4.6 Replacing the power board

- Remove the control panel and housing as described in chapter 7.4.1 and 7.4.3.
- Remove all cable connections to the power board.
- Remove screws 1-5 (figure 28).
- Use missing plug contacts and fuses of the removed power board.
- Re-assemble unit in reverse order.

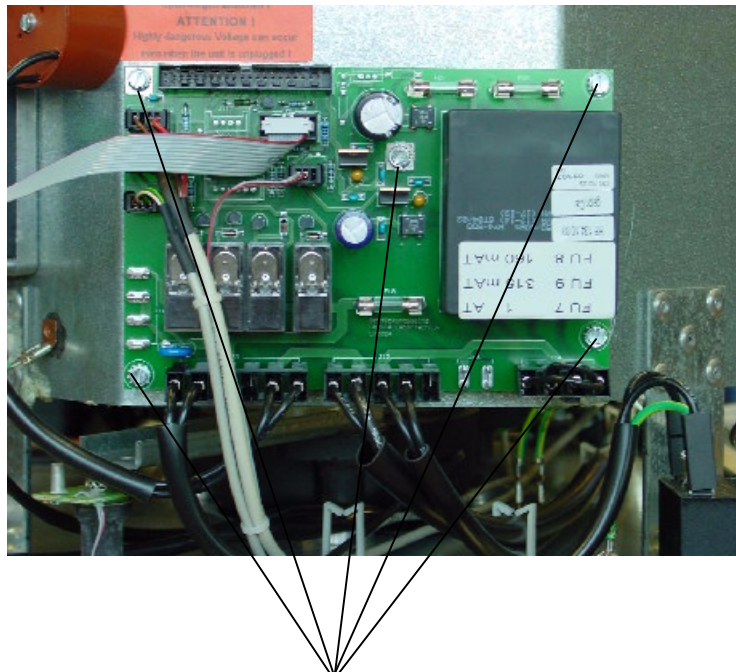


figure 28

remove

7.4.7 Replacing the frequency converter

- Remove the control panel and housing as described in chapter 7.4.1 and 7.4.3.
- Remove all cable connections to the frequency converter.
- Remove screws and remove the frequency converter from the unit (figure 29).
- ATTENTION: Before placing a new converter into the unit, put some heat conducting paste onto the fixing surface.
- Re-assemble the unit in reverse order.



figure 29

remove

7.4.8 Adjusting the imbalance sensor

- Remove the control panel and housing as described in chapter 7.4.1 and 7.4.3.
- Restore electric connections of lid lock and control panel.
- Insert a rotor and tighten it.
- Load a boring of the rotor with the shut off weight referred to in list 6.3.
When using microliter rotors you have to load several reaction tubes next to each other.
- Start the centrifuge. The unit must now switch off when reaching the speed referred to in list 6.3 for this rotor (see list 6.3).
- In case the unit does not switch off, you have to put some self glue foam strips to the imbalance sensor.
In order to decrease its sensitivity you have to take some strips away from the sensor. In order to increase its sensitivity you have to take some strips to the sensor (figure 30).
- Repeat these steps until you reach the values given in list 6.3.
- In case the unit switches off, load the rotor with the admissible imbalance.
- The unit must not switch off after starting it. In case it does, you have to increase the sensitivity.
- In case you have to re-adjust the sensor for the admissible imbalance, you have to repeat the steps for the shut-off imbalance adjustment.

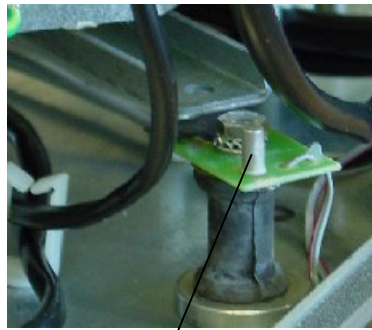


figure 30 Imbalance sensor

7.5 Refrigeration system

7.5.1 Functional description of the refrigeration system

The compressor regulates how much refrigerant is being led to the evaporator. A sensor is continuously measuring the temperature at the evaporator output. Through this, the injection nozzle of the expansion valve is controlled and the evaporator is supplied with the max. necessary amount of refrigerant. Therefore, maximum capability of the refrigeration system can be reached at any status of operation.

As soon as the required pre-set temperature is reached, the compressor will switch off. When the temperature rises again, the compressor will switch on again.

The response time of the compressor is controlled with a microprocessor control. The processor receives the chamber temperature data through a temperature sensor placed in the rotor chamber. As the actual sample temperature may not be identical to the temperature measured in the rotor chamber, the micro processor will calculate the sample temperature for the rotor in use. This temperature value is indicated in the temperature display.

The temperature adjustment of the micro processor is based on this calculated temperature value. Therefore, the user always gets the exactly requested sample temperature ($\pm 1^\circ\text{C}$). The samples are not being damaged through over or under temperature.

7.5.2 Refrigeration scheme

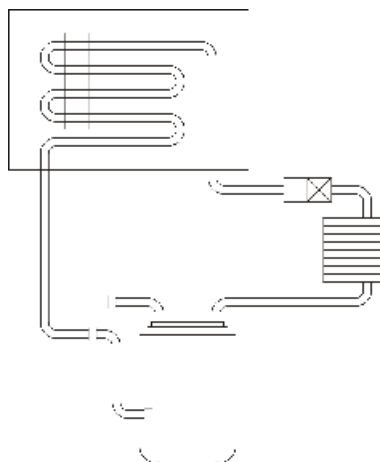


figure 31

7 SERVICE INSTRUCTIONS

7.5.3 Emptying and filling the refrigeration system (refrigerant R 404 a)

For this performance you need a refrigerant suction plant with container, a vacuum pump, a vacuum measuring device, a measuring device for refrigerants and a manometer combination.

The refrigeration system has the CFC-free refrigerant type R 404 a.

Emptying the refrigeration system:

- Remove the housing, until the refrigeration set is exposed (see chapter 7.4).
- Connect the suction plant to the valve (figure 31).
- Remove the refrigerant from the system.
- You can now perform necessary repairs.

Filling the refrigeration system:

- Connect the vacuum pump, the manometer combination and the refrigerant bottle (R 404 a) to valve 1 (figure 32).
- Evacuate the refrigeration system for approx. 30 min.
- Switch off the vacuum pump.
- Make sure, the reached vacuum stays constant after switching the pump off, otherwise the system is leaky.
- Fill the refrigeration set with 500 g refrigerant type R 404 a.
- Check all tube connections with a leakage detection device for possible leakage.

ATTENTION:

You must use refrigerant type R 404 a only!

Filling amount is 500 g!



Figure 32: Compressor, valve 1

7 SERVICE INSTRUCTIONS

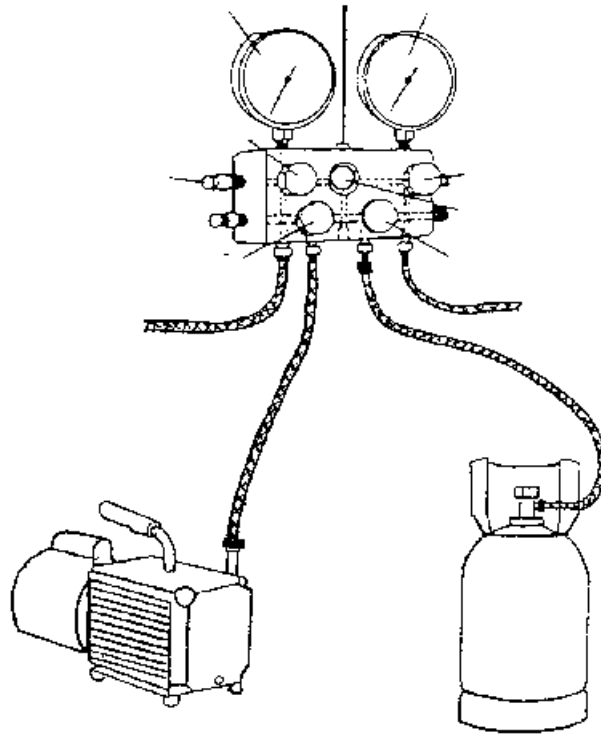


Figure 33: Manometer combination, vacuum pump, refrigerant bottle

8.1 Error messages: cause / solution

Preface:

The error messages are listed to help localize possible errors faster.

The diagnose referred to in this chapter may not always be the case, as they are only theoretically occurring errors and solutions.

Always, please keep us informed about any kind of error occurring, which is not listed in this chapter. Only through your information we are able to improve and complete this instruction manual.

Many thanks in advance for your support.

HERMLE Labortechnik GmbH

8.2 Survey of possible error messages and their solutions

8.2.1 Lid release during power failure (Emergency Lid Release)

In case of power failure or malfunction, the lid of the centrifuge can be opened manually in order to protect your samples.

Please proceed as follows:

- Switch the centrifuge off and unplug the power cord.
- At the left side of the centrifuge housing there is a plastic plug tightened to a cord.
- Pull the plastic plug out of the housing and pull the cord to open the lid of the centrifuge (see figure 34).



Figure 34

8 TROUBLE SHOOTING

8.2.2 Description of the error message system

The error message is shown in the "SPEED" display through particular figures (see figure 35).

There is a distinction between two different kinds of errors.

The digits in the "SPEED" display have the following meaning:

- **Error No. 1 – 49 (forced stop)**

In case of one of these errors occurring, the rotor decelerates from pre-set speed down to 0. As soon as the rotor stops, the error message can be reset by opening and closing the lid of the centrifuge.

- **Error No. 50 – 99 (emergency stop)**

In case one of these errors occurring, the frequency converter switches off. This means, the rotor stops without applying the brake. To reset the error message you have to switch off the unit and turn it on again (power switch).

In case the unit stops due to an error indication, you should restart the unit to check whether the error occurs again.

The error message figures not listed in this chapter are currently not in use. They are reserved for future use in completing the error message recognition program.

Example: figures are flashing



Figure 35

8.2.3 Error messages

Error No. 1: Imbalance

- Cause: Incorrect loading of the rotor (see chapter 2.2.1)
- Solution: Balance your samples

- Cause: Incorrect adjustment of the imbalance sensor
- Solution: Imbalance sensor has to be re-adjusted (call service department)

8 TROUBLE SHOOTING

Error No. 2: Permanent imbalance signal

- Cause: Incorrect position of the imbalance sensor
- Solution: Imbalance sensor has to be readjusted
(call service department)

- Cause: Imbalance sensor is defective
- Solution: Imbalance sensor has to be replaced
(call service department)

Error No. 10: Chamber overtemperature (above +50°C)

- Cause: Refrigeration system malfunction
- Solution: Wait until temperature is below +30°C again. Restart the centrifuge.
In case temperature in rotor chamber is again at about 50°C,
call service department.

- Cause: Temperature sensor is defective
- Solution: Call service department

Error No. 11: Temperature sensor defective

- Cause: Temperatur sensor defective
- Solution: Call service department. Temperature sensor has to be changed.

Error No. 25: Power failure

- Cause: Power failure while rotor was in motion
- Solution: Open and close the lid of the centrifuge, restart the unit;
check contact of plug in (loose contact)

Error No. 36: Relay of the frequency converter cannot be released / lid cannot be opened

- Cause: Power board malfunction
- Solution: Call service department

- Cause: Lid of the centrifuge is jammed
- Solution: Open the lid of the centrifuge manually when rotor is at stand still. Grease the lid lock slightly. In case this error occurs again, call service department;
check coil of lid lock

- Cause: Lid lock is defective
- Solution: Call service department, replace lid lock

Error No. 50 / 51: Memory failure

- Cause: Internal or external memory failure
- Solution: Restart the unit. In case this error occurs again, call service department;
replace control panel

8 TROUBLE SHOOTING

Error No. 54: Wrong configuration

- Cause: Jumper is placed at the wrong position on control panel
- Solution: Re-place jumper

Error No. 55: Overspeed

- Cause: Speed sensor is defective
- Solution: Restart the unit. In case this error occurs again, call service department. possibly loose speed magnet, fix with super glue

Error No. 60: Engine speed sensor signal is missing

- Cause: Speed sensor is defective or cable breakage at speed sensor, possibly lose magnet
- Solution: Call service department; check speed magnet, fix with super glue

Error No. 82: Cut off power board –frequency converter

- Cause: Overcurrent or undervoltage due to power supply fluctuations
- Solution: Restart the unit, take care the power supply is stable

Error No. 83: Preset speed cannot be reached

- Cause: Preset speed cannot be reached
- Solution: Call service department

Error No. 84: Overtemperature frequency converter

- Cause: Frequency converter cut off due to overtemperature
- Solution: Take care, there is enough space around the centrifuge for heat dissipation

Error No. 85: Overtemperature motor

- Cause: Temperature protection switch of motor turns off
- Solution: Take care, there is enough space around the centrifuge for heat dissipation. Motor mounting is defective, replace motor

Error No. 90: Emergency switch off lid lock

- Cause: The lid of the centrifuge has been opened while centrifuge was running
- Solution: Close the lid of the centrifuge. DANGER OF ACCIDENT!
- Cause: Control switch of lid lock is defective
- Solution: Call service department

9.1 Service and maintenance

9.1.1 Maintenance and cleaning

Maintenance:

Maintenance of the centrifuge is confined to keeping the rotor, the rotor chamber and the rotor accessories clean as well as to regularly lubricating the rotor insert bolts of a swing out rotor (if available).

Vaseline, available in nearly each store, is the most suitable lubricant. The Vaseline must be free of resin and acids. Lubricants containing molybdate and graphite are not allowed.

Please pay special attention to anodized aluminium parts. Breakage of rotors can be caused even by slightest damages.

In case of rotors, buckets or tube racks getting in touch with corrosive substances the concerned spots have to be cleaned carefully.

Corrosive substances are for instance:

- Alkalis
- Alkaline soap solutions
- Alkaline amines
- Concentrated acids
- Solutions containing heavy metals
- Water-free chlorinated solvents
- Saline solutions, e.g. salt water

Cleaning:

Thorough cleaning not only has its purpose in hygiene but also in avoiding corrosion based on pollution.

In order to avoid damaging anodized parts such as rotors, reduction plates etc., only pH-neutral detergents with a pH-value of 6-8 may be used for cleaning.

Alkaline cleaning agents (pH-value > 8) must not be used.

After cleaning, please ensure all parts are dried thoroughly, either by hand or in a hot-air cabinet (max. temperature + 50°C).

It is necessary to coat anodized aluminium parts with anti-corrosion oil regularly in order to increase their life-spans and reduce corrosion predisposition.

Due to humidity or not hermetically sealed samples, condensate may be formed. The condensate has to be removed from the rotor chamber with a soft cloth regularly.

The maintenance procedure has to be repeated every 10 to 15 runs, but at least once a week.

9.1.2 Glass breakage

With high g-values, the rate of glass tube breakage increases. Glass splinters have to be removed immediately from rotor, buckets, adapters and the rotor chamber itself. Fine glass splinters will scratch and therefore damage the protective surface coating of a rotor.

If glass splinters remain in the rotor chamber, fine metal dust will build up due to air circulation. This very fine, black metal dust will extremely pollute the rotor chamber, the rotor, the buckets and the samples.

9.1.3 Disinfection

In case of infectious material spilling into the centrifuge, the rotor and rotor chamber have to be disinfected right after the run. Rotors may be autoclaved at a maximum temperature of 121°C, except rotor 220.58 V08, which must not be autoclaved.

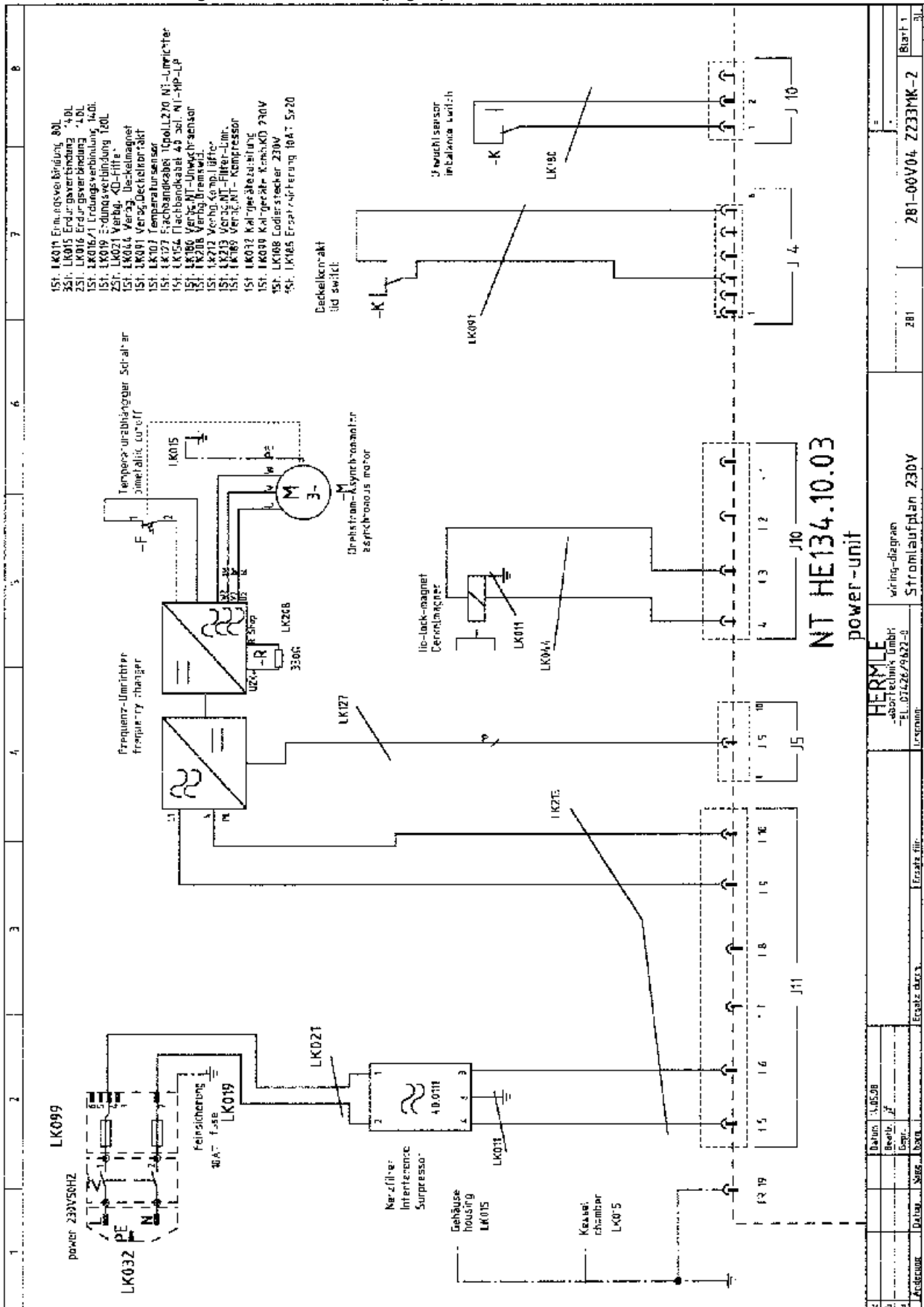
The rotor and rotor chamber should be cleaned with a universal, neutral disinfection agent, e.g. on formalin base. A disinfection spray is most suitable in order to easily reach all difficult to access spots.

ATTENTION:

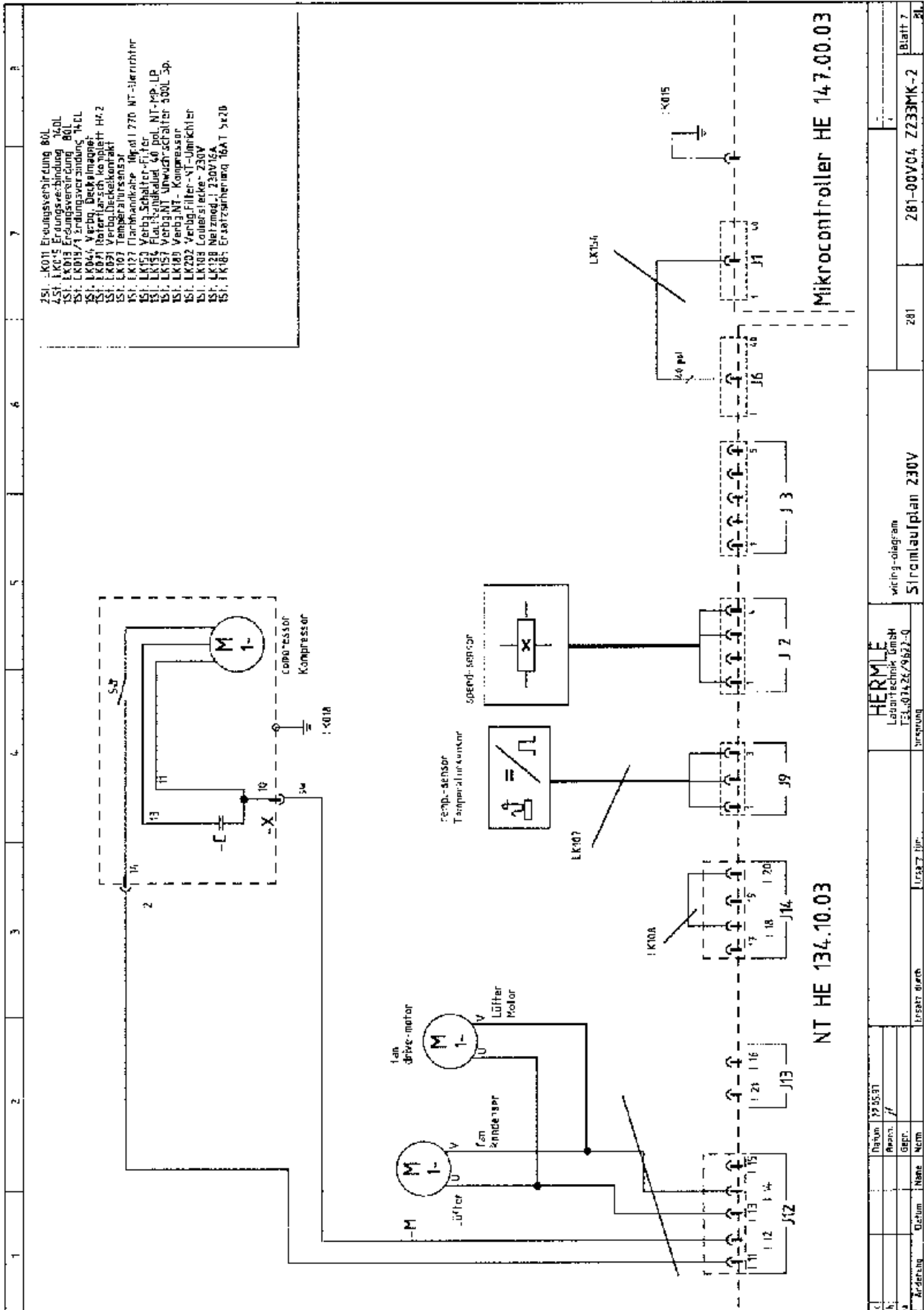
Before applying any other cleaning resp. decontamination method than recommended by the manufacturer, contact the manufacturer to ensure yourself, you would not damage the unit or the rotor by applying the designated method!

10.1 Flow diagram

10.1.1 Flow diagram 230 V / 50-60 Hz (page 1)



10.1.1 Flow diagram 230 V / 50-60 Hz (page 2)

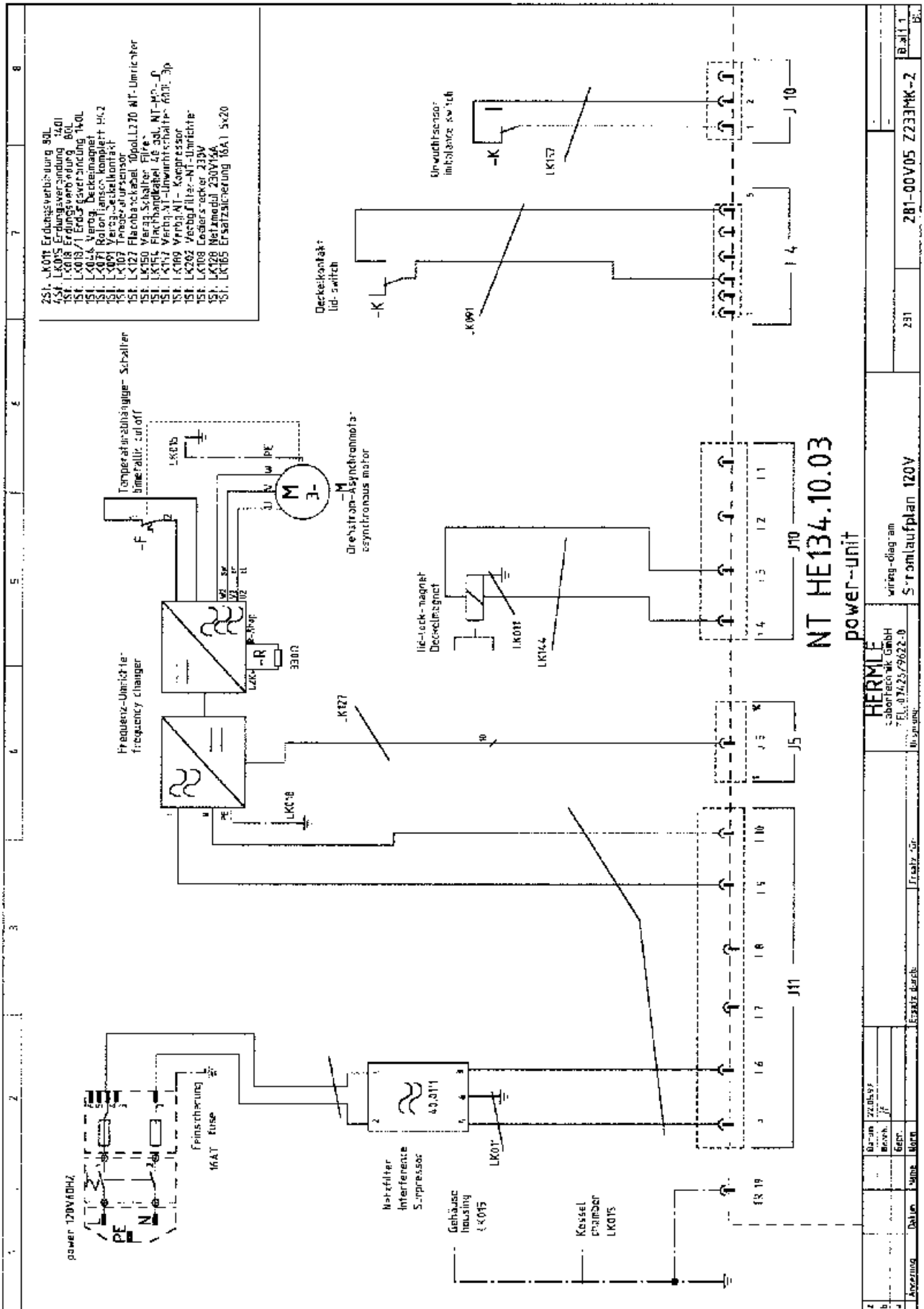


NT HE 134.10.03

Mikrocontroller HE 14.7.00.03

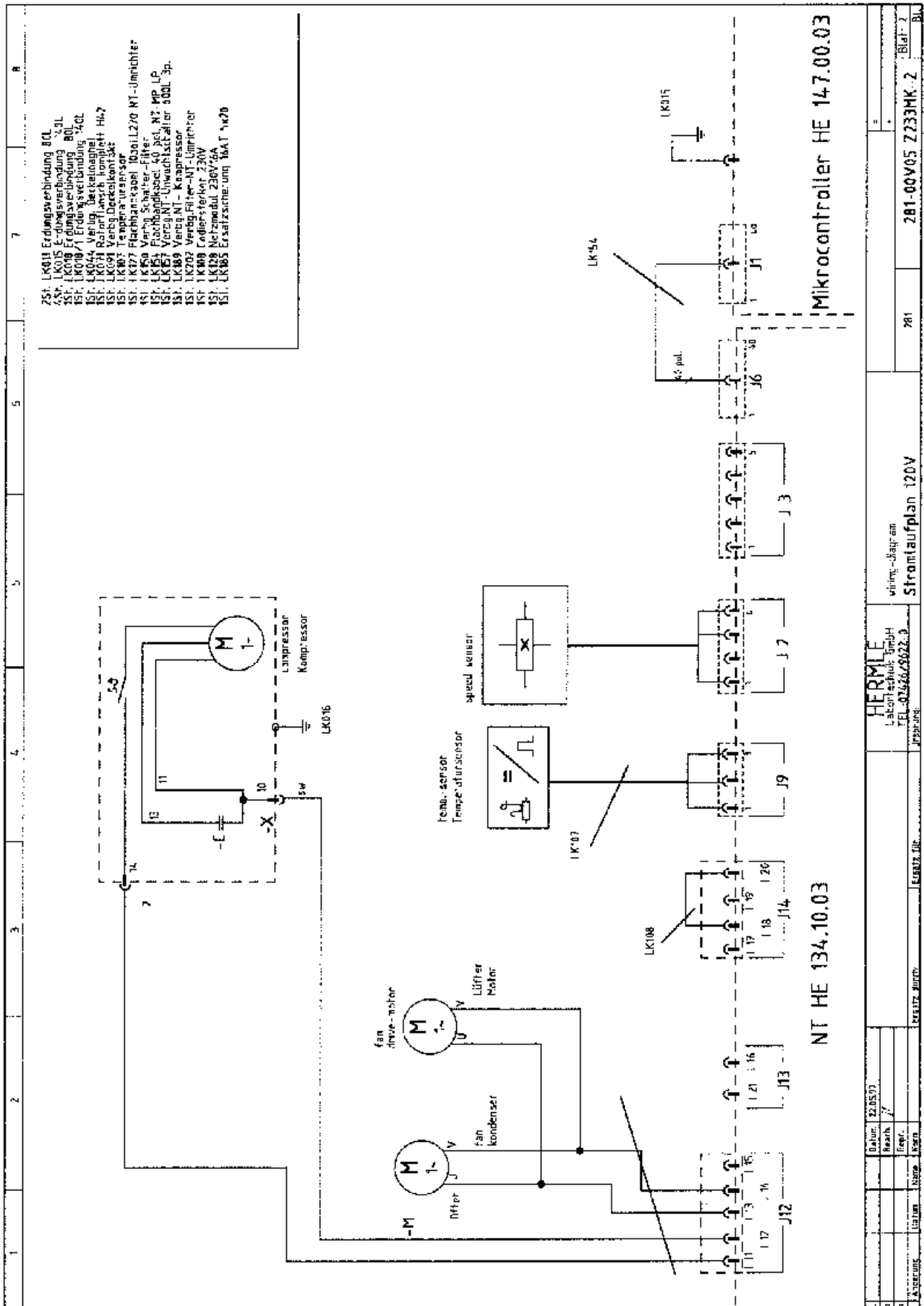
HERMLE Labortechnik GmbH TEL: 0714249822-0		Stromtauplan 230V		281		281-00V04_Z233MK-2		Blatt 7	
Erstellung		Ersatz durch		Ersatz durch		Ersatz durch		Ersatz durch	
Datum		Name		Name		Name		Name	
Gepr.		Gepr.		Gepr.		Gepr.		Gepr.	
Revis.		Revis.		Revis.		Revis.		Revis.	
Zust.		Zust.		Zust.		Zust.		Zust.	

10.1.2 Flow diagram 120 V / 50-60 Hz (page 1)



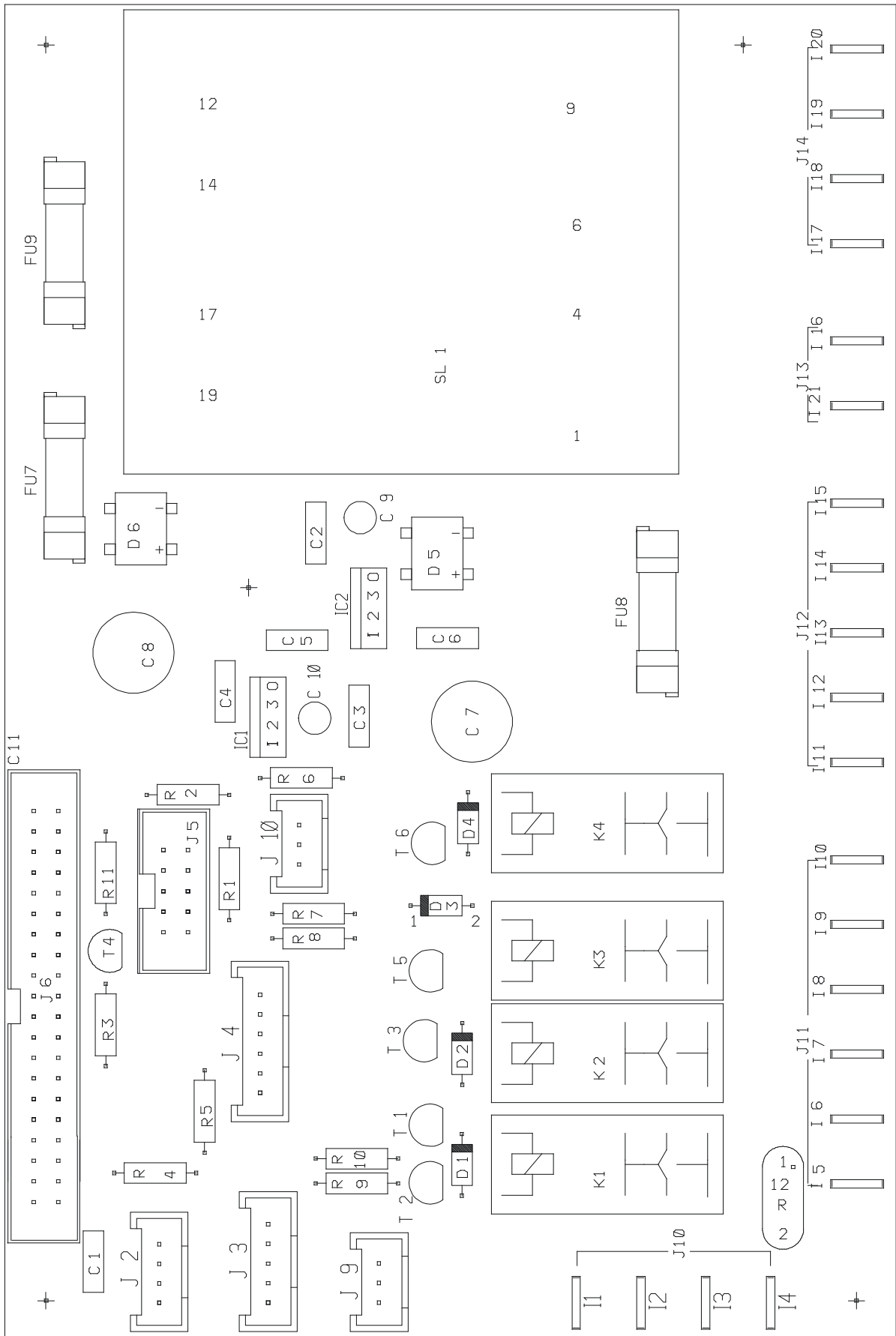
10 CIRCUIT DIAGRAMS

10.1.2 Flow diagram 120 V / 50-60 Hz (page 2)

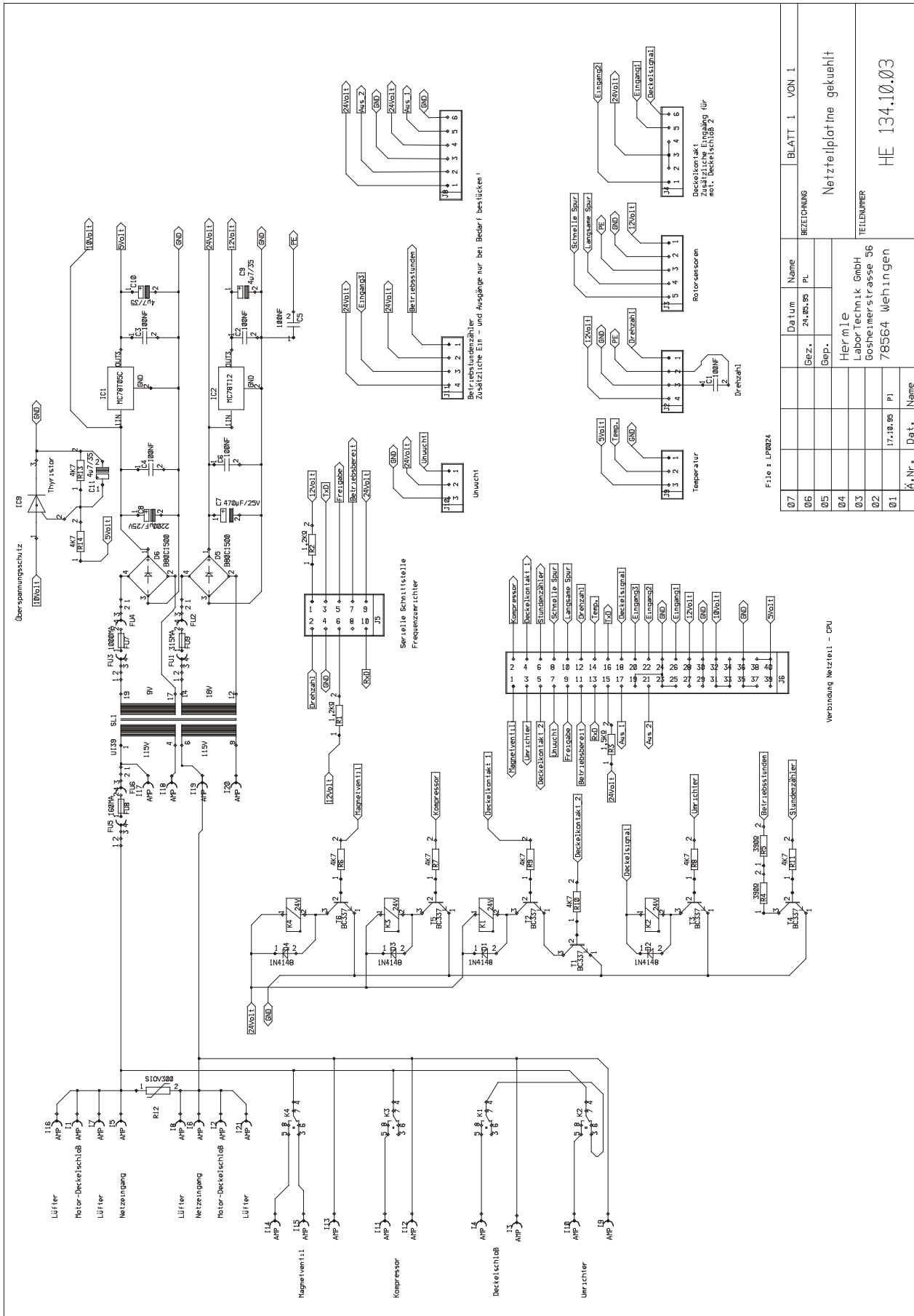


10.2 Power board

10.2.1 Assembly plan

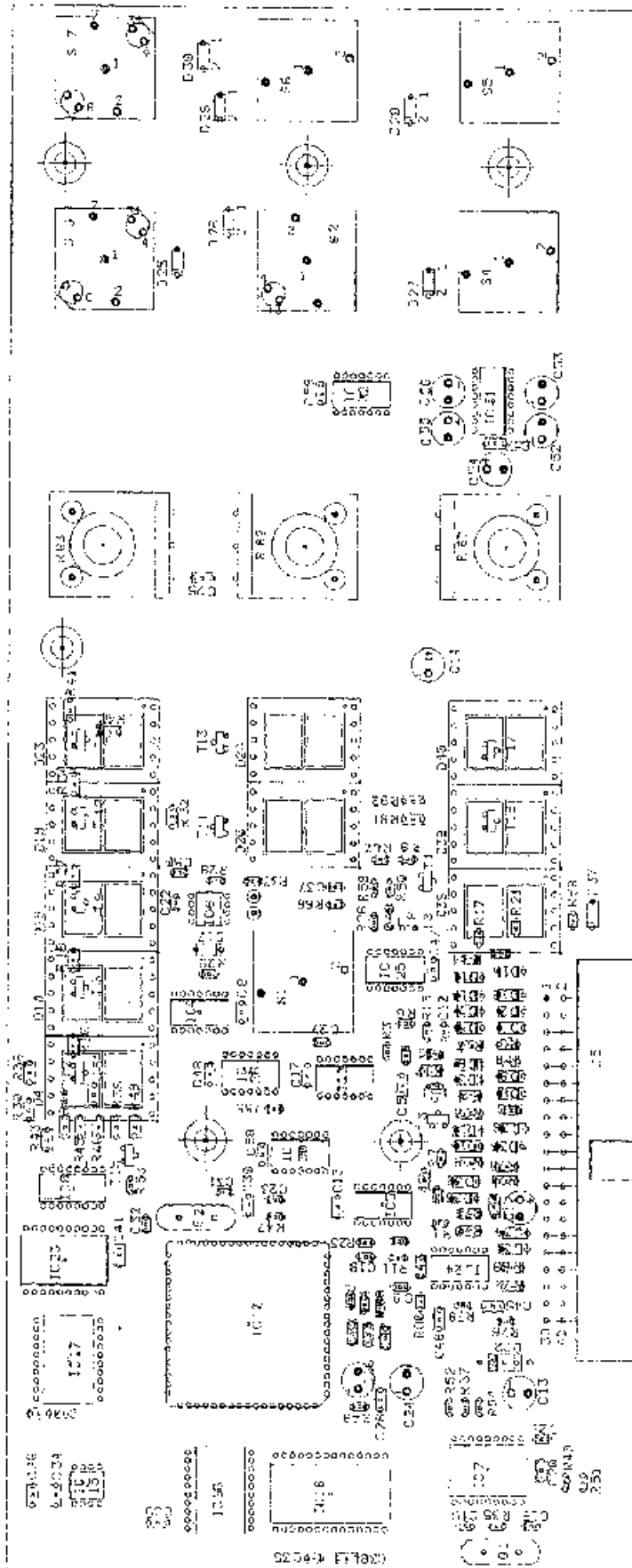


10.2.2 Circuit diagram

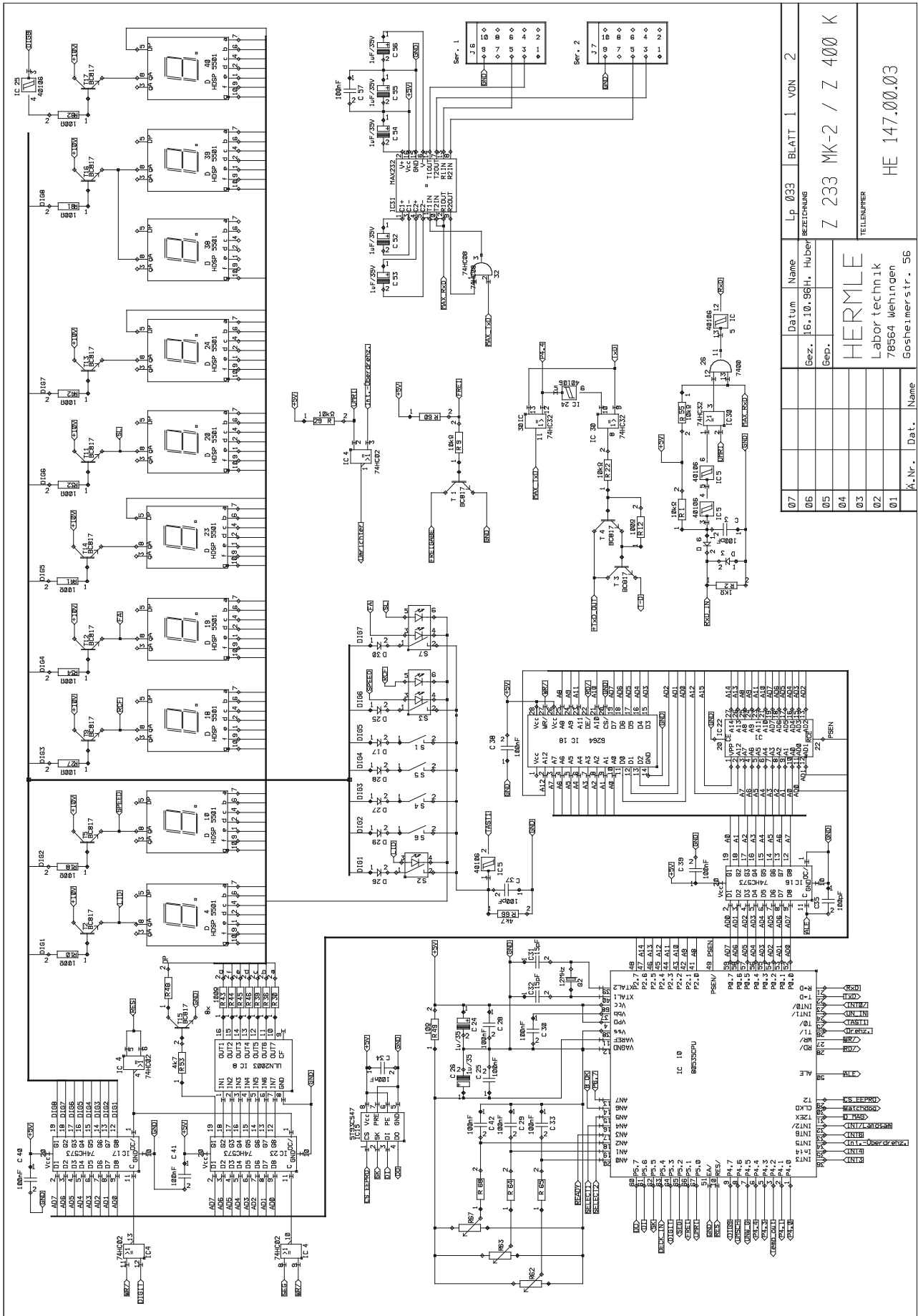


10.3 Control panel

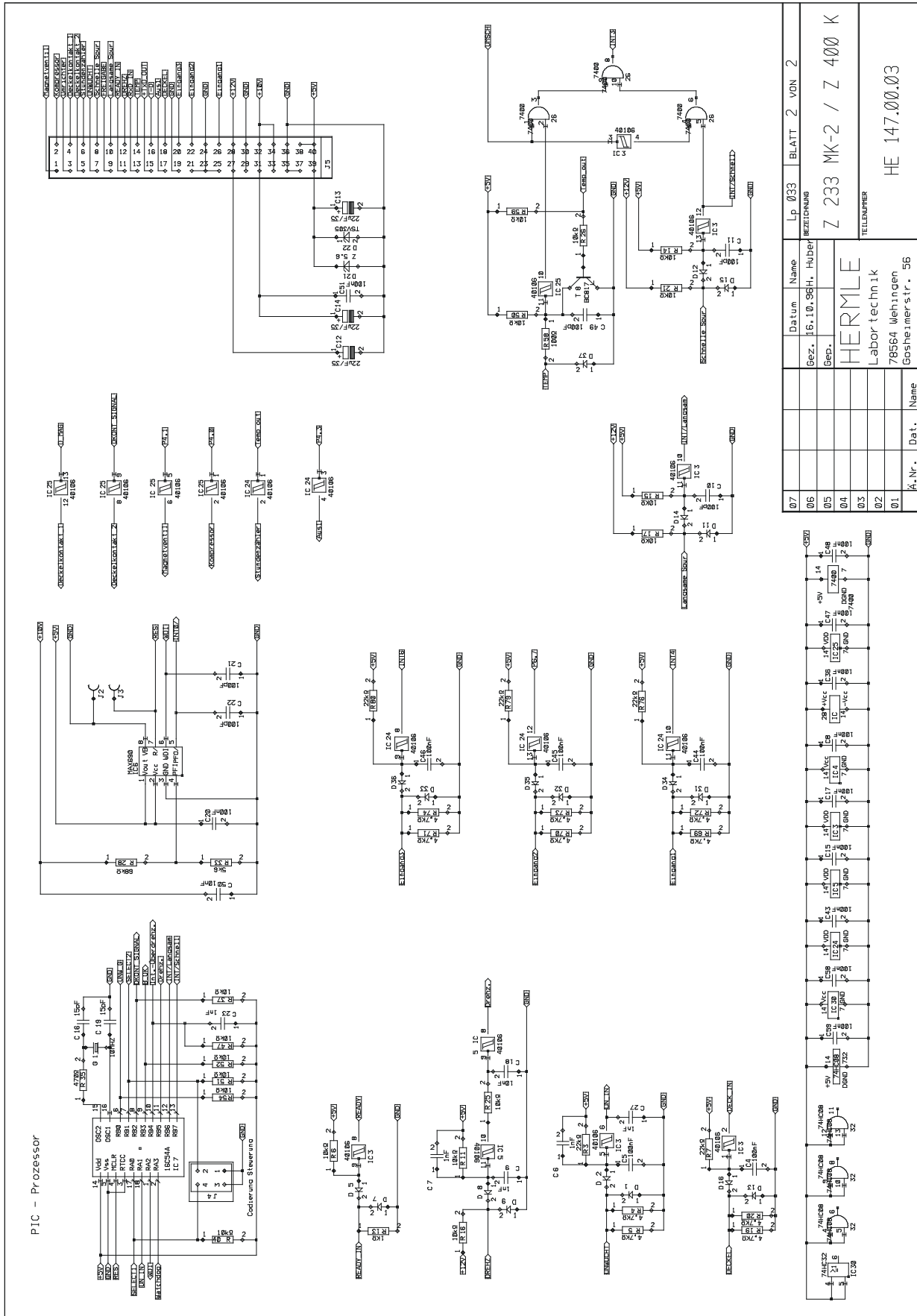
10.3.1 Assembly plan



10.3.2 Circuit diagram (page 1)



10.3.2 Circuit diagram (page 2)



Lp 033		BLATT 2 VON 2	
Datum	Name	Gez.	Bezeichnung
07			
06			
05			
04			
03			
02			
01			
HERMLE		Z 233 MK-2 / Z 400 K	
Labortechnik		TEILENUMMER	
78564 Wehingen		HE 147.00.03	
Gosheimstr. 56			
A.Nr.	Dat.	Name	

11 SPARE PART LIST

ARTICLE	ORDER NO.	IDENT NO.
frequency converter, 230 V with 1 PCB	913.020	20-0241
frequency converter, 120 V with 1 PCB	913.021	20-0242
power board for control panel with 1 PCB 120 V / 230 V	913.022	HE 134.10.03
control panel	913.039	287.01.19.03
motor, 230 V	923.010	283.08.40.02
motor, 120 V	923.011	283.08.39.02
lid complete (spring hinge version)	933.045	287.01.09.02
housing upper part without lid (for hinge version)	933.046	287.01.10.01
sealing for rotor chamber	933.047	287.01.08.04
fuse holder 230 V	940.026	25.0096
fuse holder 120 V	940.027	25.0098
cover for fuse holder	940.032	25.0109
rocker switch "power" vertikal	940.086	38.0202
line filter, 230 V / 120 V	940.160	40-0111
rotor sensor	940.172	LK071
temperature sensor for control panel with 1 PCB (digital)	940.179	LK107
lid lock, 120 V	940.193	278.08.11.03
lid lock, 230 V	940.194	278.08.12.03
speed sensor (brown housing)	940.199	32-0220
imbalance sensor	940.210	LK180
fuse set, 230 V (16 AT)	940.213	LK185
fuse set, 120 V (16 AT)	940.214	LK186
power connection with fuse holder, 230 V	940.217	LK128
power connection with fuse holder, 230 V	940.218	LK134
magnet for speed sensor (without housing)	940.236	44-0047
Potentiometer 10 K	940.245	940.245
speed sensor (white housing)	940.263	940.263
magnet for speed sensor (with housing)	940.264	940.264
lid latch	950.008	23.5132
centrifuge rubber feet (glued)	950.014	26.5034
centrifuge rubber feet (glued)	950.036	35.5022
motor rubber mount	950.063	26-5168
motor cover	950.128	270.01.48.03
Hinge	950.131	38-5597
vibration transducer	950.144	250.08.01.04
sight glas	960.034	244.00.51.04
Dryer	960.042	39-5103
pressure guard	960.055	23-5149
expansions valve	960.056	24-5078
compressor, 120 V, (R404a)	960.057	41-5180
condenser with fan, 230 V	960.058	41-5182
compressor, 230 V, (R404a)	960.059	41-5181
condenser with fan, 120 V	960.060	41-5183
starting relay 220 V L'unite	960.067	960.067
starting relay 120 V L'unite	960.068	960.068
starting capacitor 220 V L'unite	960.076	960.076
starting capacitor 120 V L'unite	960.077	960.077
power board 120 / 230 V (exchange part)	R913.022	RHE 134.10.03
control panel (exchange part)	R913.039	R287.01.19.03